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NICOTINE DUST FOR CONTROL OF THE STRIPED CUCUMBER BEETLE

(A PRELIMINARY REPORT)

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NICOTINE DUST FOR CONTROL OF THE STRIPED CUCUMBER BEETLE.

A PRELIMINARY REPORT.

INTRODUCTION.

In the early summer of 1921 the striped cucumber beetle (*Diabrotica vittata* Fab.) became very abundant on seedling cucumbers, melons, squash, and related crops grown at the Arlington Farm, Rosslyn, Va. Nicotine sulphate mixed with kaolin and lime had been used so successfully by R. E. Campbell,[1] of the Bureau of Entomology, for the control of *Diabrotica soror* Lec. and *D. trivittata* Mannh. on cucurbits in California that the writer thought that the related striped cucumber bettle, the most destructive enemy to seedling cucurbits in the East, could be controlled by the same mixture. A $\frac{3}{4}$-acre plot, planted to cucumbers, melons, and squash and pumpkin of different varieties was used to test out nicotine in a dust carrier. The beetle confined its attack principally to squash and pumpkin; in fact, the melons and cucumbers were fed on only sparingly.

In the experiments conducted the dust was applied with hand dusters of various types. As the insects are very active and take flight at the slightest disturbance, an apparatus which will throw a good volumne of dust with force and with least effort on the part of the operator is necessary. This is also essential because the beetles enter cracks in the soil at the base of the plant, there to feed upon the stem, and must be either driven from their hiding places or killed. The machine that proved the most effective was of the knapsack-bellows type.

When the dust strikes the beetles, they become very active and make an effort to escape either by flight or running. Those receiving sufficient dust to prevent flight are able to crawl only a few inches before paralysis overtakes them, followed in a few minutes by death. Others with dust-covered bodies flew from 5 to 10 yards, then dropped to the earth, and died. A very small number escaped.

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[1] Campbell, R. E. Nicotine Sulphate in a Dust Carrier Against Truck-Crop Insects. U. S. Dept. Agr. Cir. 154. 15 p., 5 fig. November 23, 1921.

During these tests there was little rainfall. The dust remained on the plants longer than it would normally and that at the base of the plants did not deterioriate very rapidly.

The best results were obtained when the application was sufficient to form a good covering on the plant and on the surface of the ground about the base. When applied in this manner about 15 pounds of dust per acre were required. The cucurbits, with the exception of cucumbers, were planted in hills 6 feet apart with 6½ feet between the rows. The cucumbers had 3½ feet between the rows and were 4 feet apart. In this series of experiments dust containing various strengths of nicotine sulphate was used as follows: 4 per cent, 6 per cent, and 8 per cent, equivalent to 1.6 per cent, 2.4 per cent, and 3.2 per cent nicotine, respectively. As ground quicklime was difficult to obtain, air-slaked lime was substituted, and with this exception the material was the same as that used by Mr. Campbell: that is, kaolin 75 pounds, ground quicklime 25 pounds, and nicotine sulphate.

EXPERIMENTS.

TABLE 1.

Experiment I.—May 31, 1921, the squash plants were in the first-leaf stage and the beetles had made their first appearance. Forty hills were dusted with a mixture containing 4 per cent nicotine sulphate. The dust was applied with a small hand-bellows duster and a cheesecloth sack. The hand bellows applied the mixture in a very thin cloud and allowed a number of the beetles to escape without coming into contact with the dust. With the use of the cheesecloth sack (Fig. 1), a large quantity of dust was expelled with each downward motion of the arm. This was sufficient to catch the beetles before they had time to take flight. Even with this method a small number of beetles escaped with their bodies covered with dust. Some of these, however, might eventually have died.

Results: Upon close examination of the dusted plants on June 2, only 3 live beetles were found in 20 hills examined.

Experiment II.—May 31, 40 hills of watermelons and 60 hills of squash were dusted with a mixture containing 6 per cent nicotine sulphate, applied with a hand fan-type duster.

Results: Such plants as were examined June 3 showed 60 beetles to 20 hills of squash.

Experiment III.—May 31, 20 hills of squash and 40 of pumpkin were dusted with 8 per cent nicotine sulphate, applied with a hand-bellows type duster.

Results: Upon close examination, June 3, 30 beetles were found on the 60 hills dusted.

Experiment IV.—June 3, 200 hills of melons, squash, and pumpkin were dusted with a mixture containing 8 per cent nicotine sulphate. The dust was applied with a knapsack bellows type (Fig. 2), and in all subsequent experiments this type was used.

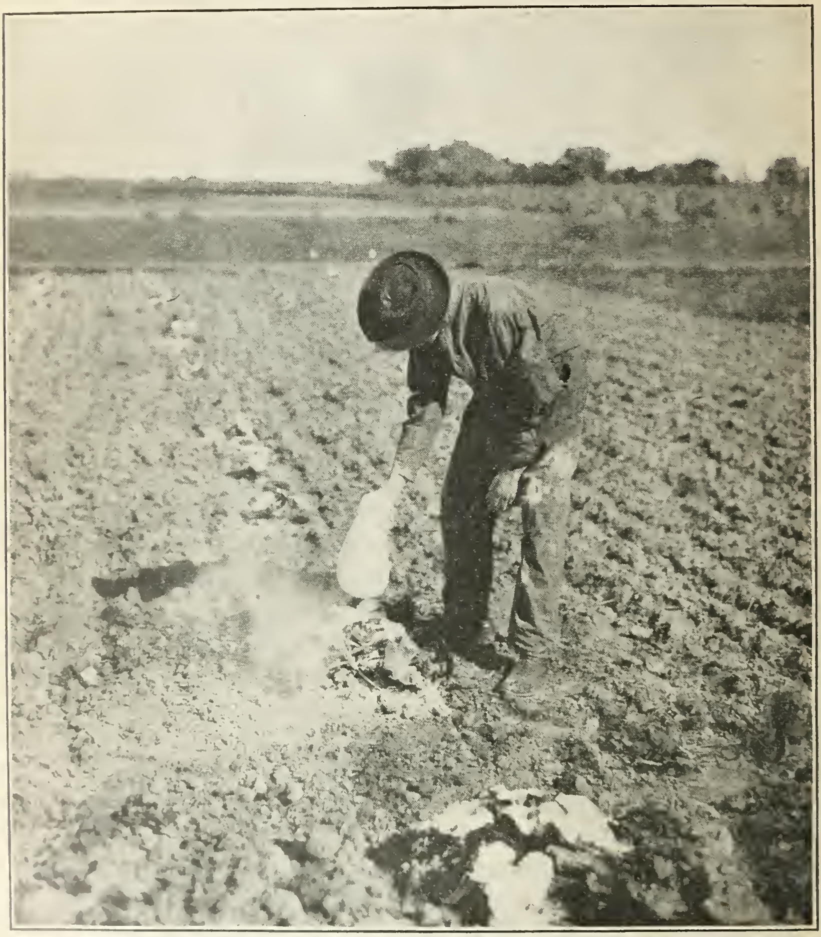

Fig. 1.—Dusting cucurbits with a cheesecloth bag for control of the striped cucumber beetle.

Results: Upon examination, June 9, very few beetles could be found on the dusted plants, although the beetles had fed to a small extent on the new growth of the watermelons.

Experiment V.—June 4, 180 hills of squash were dusted with a mixture containing 4 per cent nicotine sulphate.

Results: A number of beetles were collected and placed in a well-ventilated enclosure after application of the poison dust and 95 per cent of these succumbed shortly afterwards. Of those caught in flight after the application, 90 per cent succumbed. June 9, very few beetles were found and some of the plants had made new growth, which was exposed to attack.

Experiment VI.—June 6, 80 hills of squash which had not been included in these experiments and on which the beetles had congregated and were feeding extensively, after being driven off the dusted areas, were dusted with a mixture containing 4 per cent nicotine sulphate.

Results: June 7, 3 live beetles were found upon 80 hills.

Experiment VII.—June 14, 160 hills of squash, melons, and pumpkins were dusted with a mixture containing 4 per cent nicotine sulphate, although the beetles at this time were not very abundant.

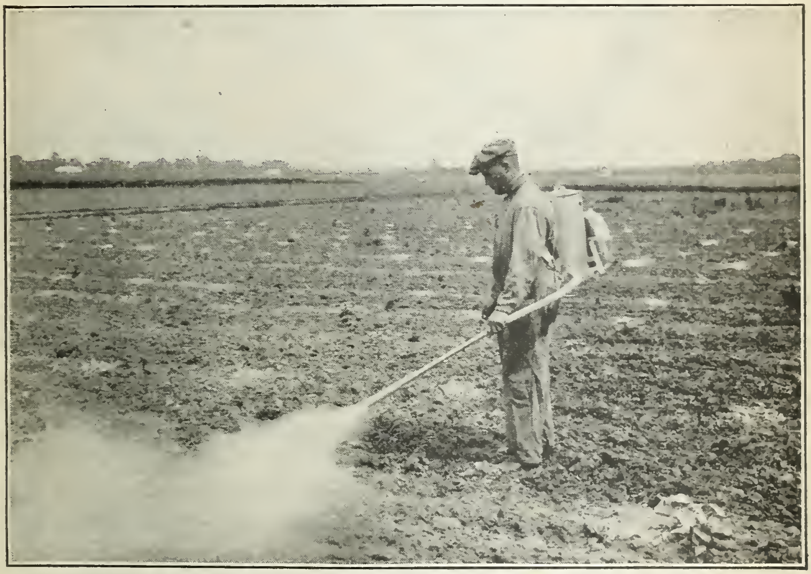

Fig. 2.—A good type of knapsack-bellows duster to use in control of the striped cucumber beetle.

Results: June 16, the plants, on being examined, showed only 6 live beetles on 22 hills of squash, while the melons and pumpkins were found to be entirely free from beetles.

Experiment VIII.—June 26, squash plants that had developed to the first-leaf stage were dusted with a mixture containing 4 per cent nicotine sulphate. The beetles were very abundant, ranging from 20 to 40 beetles to the hill.

Results: The plants were examined the following day and not a single beetle was found. A number of these beetles were captured after application of the dust and placed in confinement, but despite the fact that conditions as nearly natural as possible were maintained all soon succumbed.

Table 1.—*Experiments in the use of nicotine sulphate dust against the striped cucumber beetle.*

Exp. No.	Date.	Nicotine sulphate content, per cent.	Infestation.	Plants dusted.	Type of duster.	Date examined after application.	Results.
	1921.						
I	May 31	4	First appearance abundant.	Squash, 40 hills.	Hand bellows; cheesecloth sack.	June 2	3 live beetles found on 20 hills examined.
II	May 31	6	do	Watermelon, 40 hills; squash, 60 hills.	Hand duster, fan type.	June 3	60 living beetles to 20 hills of squash.
III	May 31	8	do	Squash, 20 hills; pumpkin, 40 hills.	Hand duster, bellows type.	do	30 living beetles on 60 hills examined.
V	June 3	8		Melons, squash, pumpkin, 200 hills.	Knapsack, bellows type.	June 9	Few beetles. New growth fed on slightly.
V	June 4	4		Squash, 180 hills.	do	do	Few beetles found. Slight feeding on new growth. 90 per cent to 95 per cent beetles collected after application succumbed.
VI	June 6	4	Very abundant.	Squash, 80 hills.	do	June 7	3 live beetles on 80 hills.
VII	June 14	4	Not abundant.	Squash, melons, pumpkins, 160 hills.	do	June 16	6 live beetles on 22 hills of squash; melons and pumpkins entirely free.
VIII	June 26	4	Very abundant, 20 to 40 to the hill.	Squash	do	June 27	Not a single beetle found on plants examined. Of beetles captured after application 100 per cent succumbed.

In connection with this work active cooperation was obtained with W. G. Shipley, of College Park, Md., who makes a specialty of growing muskmelons. Mr. Shipley reports that he used a 6 per cent dust with success on muskmelon, watermelon, and cucumber on May 28, 1921, when the beetles were plentiful and had been feeding since the melons were set out from the hotbed. In later applications a 4 per cent mixture was used with equal success.

HOW TO PREPARE THE DUST.

This dust contains kaolin or china clay, air-slaked lime, and nicotine sulphate. Kaolin is used in the manufacture of pottery and can be purchased from such manufacturers for a few cents a pound. The proportions of the dusts used should be 75 per cent kaolin and 25 per cent lime, and to this the desired amount of nicotine sulphate is added. Thus to prepare 100 pounds of dust containing 4 per cent nicotine sulphate use the following

FORMULA.

Kaolin	pounds	72
Lime	do	24
Nicotine sulphate	do	4

For smaller amounts this can be reduced proportionately, as 9 pounds of kaolin, 3 pounds of lime, and 8 ounces of nicotine sulphate; total, 12½ pounds of dust containing 1.6 per cent of nicotine.

In the preparation of this dust it is very important that the nicotine sulphate be thoroughly mixed with kaolin and lime. This can be accomplished by first mixing and sifting the kaolin and lime, then combining the required amount of nicotine sulphate with the dust, adding the nicotine slowly and mixing all thoroughly. The nicotine sulphate can be added to the dust by the use of any convenient sprinkler. A pint fruit jar with a metal top from which the porcelain has been removed, punched with holes by the use of a 6-penny nail, makes a good sprinkler. After the addition of the nicotine sulphate the mixture should be run through a fine sieve, 20 meshes to the inch, with the aid of a brush. This last operation should be repeated at least three times. Be sure that all the material is worked through the sieve, since if this be neglected a large quantity of the nicotine may be lost.

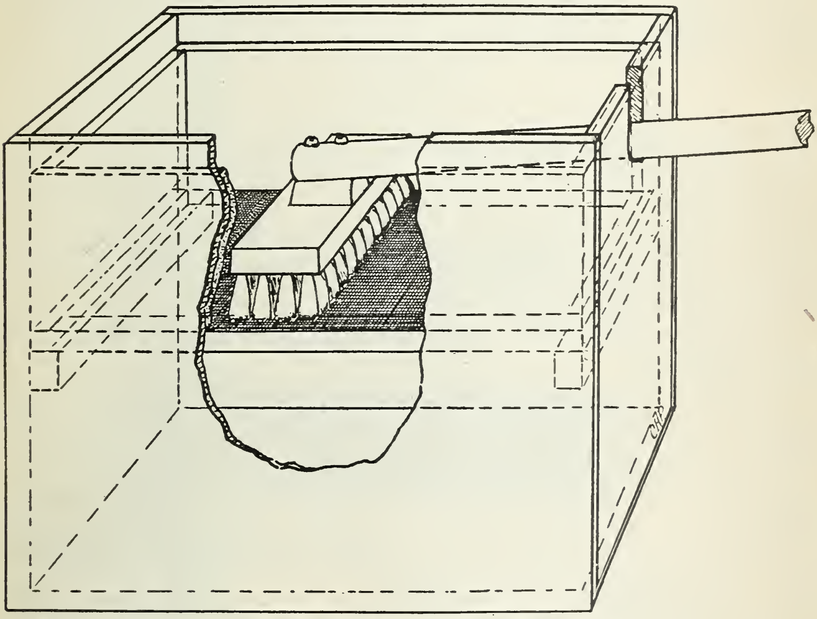

Fig. 3.—A mixer for use in the preparation of small quantities of nicotine dust.

A very satisfactory and simple method of mixing the dust consists in the use of a box with a detached cover in which a sieve is placed and an ordinary floor brush with a handle is attached (Fig. 3). A slot is cut in the side of the box so as to allow operation of the brush with the cover on. The cover to a large extent prevents the escape of the dust during the mixing process, and consequent inconvenience to the operator.

The dimensions of a box in which 12½ pounds of the dust can be conveniently mixed are as follows: Length, 15 inches; width, 10 inches; depth, 12 inches.

The sieve is constructed of brass screen, 20 meshes to the inch, tacked to a frame 4 inches deep.

The sieve fits snugly inside of the box and rests on a strip 5½ inches from the upper edge of the box.

The brush is an ordinary floor brush with edge trimmed off so that the corners and edges of the sieve may be reached.

The handle, 20 inches in length, attached at right angles to the brush, is so constructed that the brush will rest in a level position over the entire length of the sieve and that the end of the handle will come through a slot in the upper end of the box.

SUMMARY.

Nicotine sulphate, when applied in a mixture with a dust to young cucumbers, melons, and related crops, will protect them from the ravages of the striped cucumber beetle.

A dust mixture containing 4 per cent nicotine sulphate proved as effective as higher percentages of nicotine and is therefore recommended for use against this insect.

One-fourth to one-half of an ounce to the hill proved effective for one application.

The dust acts as a repellent as well as a contact insecticide. When applied properly it drives the insects from the cracks in the soil at the base of the plant, thereby preventing serious injury.

The dust must be applied so as to prevent the beetle from escaping by flight.

This can be accomplished by a duster that will throw a good volume of dust quickly and with force.

A cheesecloth sack (Fig. 1) or a knapsack-bellows type of duster (Fig. 2) is effective on small areas.

Apply the dust to the plant so that it will be well covered.

Make the first application as soon as the plants appear above ground. The insect makes its first appearance suddenly and in large numbers and serious damage may result if this application is neglected.

The number of applications depends upon the abundance of the beetles and weather conditions.

Keep the plants and the soil at the base of the plant well covered with dust until all danger of injury is passed. In the vicinity of the District of Columbia this period is normally about three weeks.